Remarks

The Examiner's reconsideration of the application is urged in view of the amendments above, the following corrections and the attachments hereto and comments which follow.

The Examiner objects that with the substitute specification, filed July 18, 2005, a marked-up copy of the substitute specification has not been supplied with the clean copy. There was no substitute specification filed, but rather only a replacement portion from page 2 through page 6. However, in order to meet this objection, a marked-up copy of the corrected portion of the specification is attached.

Starting with the last paragraph of page 2, the Examiner is rejecting claims 1 through 5 under 35 U.S.C. § 102 as being anticipated by Buckley et al. U.S. Patent 5,969,756. Reconsideration is requested.

First of all, the device and the method described in the present application is of a completely different nature and concept than the ones disclosed in Buckley et al. '756.

In the present application, a system/method is described whereby a certain number of light sources projects a test pattern grid on a screen. Each light source is directed in a way that a pre-calculated point is visualized on that screen. In this way a kind of fixed reference grid is obtained on the screen. This reference grid is then used for guiding the alignment of one or more projectors, which are projecting images on that screen (see description, the paragraphs "Technical Field of the Invention", "Summary of the Invention", second section and para. "Description of preferred Embodiments", first section).

In Buckley '756 a test and alignment system for a CRT is disclosed.
In the test part of the system, an electronic test pattern generator (Fig. 1, 26) feeds test patterns (in the form of electrical signals) to a CRT 12 and these patterns are displayed by the CRT 12. A certain number of optical sensors 16 (CCD cameras 54, 58) capture images of the displayed test patterns. These images are converted to electrical signals (video image signals) which, after processing, are fed to a computer (20) for analysis (see col. 8, the para. "Test and alignment operation"). Applicants draw the attention of the Examiner to the difference

between "optical sensor" and "source of light". On page 5, last three lines, of the Office communication, the Examiner asserts that "optical sensors 16 are sources of light." According to Webster's Encyclopedic Unabridged Dictionary of the English Language, Edition 1996, a sensor is " a mechanical device sensitive to light, temperature, radiation level, or the like that transmits a signal to a measuring or control instrument." On one hand, a source of light is not a device sensitive to light but simply a device producing light. It follows from this definition that a source of light generates light whereas an optical sensor receives lght and transduces light energy into something else, e.g. an electrical output. On the other hand, the optical sensors 16 of '756 receive light from the CRT screen (is thus sensitive to light) and transmit electrical signals to a computer. From the drawings and the description it is clear that these signals from the sensors are in electrical form – see Fig. 1, the electrical signals from the sensors 16 are sent to a multiplexer 10 and then to a computer 20 via a controller 68. Video image signals in this context relates to electrical signals and not optical signals. Thus the optical sensors 16 cannot be considered as sources of light.

In the alignment part of the system, the results of the analysis, made by the computer, are used for aligning the different elements of the CRT. As an example, in case of testing and aligning the focus of the CRT and when the results of the test are negative, the focussing voltage aplied to the CRT may be adjusted by the scan unit (32) (see col. 8 and 9, the bridging paragraph "Focus"). A similar test and alignment process is also possible for other parameters of the CRT. For certain parameters, it may be necessary to give the electron beams within the CRT a supplementary deflection in vertical and/or horizontal direction. This deflection is obtained by a wobulator (18) (see col. 9, l. 27 – 50). It may also be important to draw the attention to the fact that in the US Patent '756, the test pattern generator is a well-known electronic circuit, generally indicated in the drawing by 26. The test pattern generator itself is part of a broader system, the test and alignment system. This test and alignment system comprises:

the test pattern generator 26;

a test fixture 14 comprising a frame and a plurality of optical sensors 16 (CCD cameras) and a wobulator 18;

a computer 20 controlling the test pattern generator for determining the testpattern to be used and

a display 24 (see Figure 1 and col. 2, l. 35 – 49 and col. 3, l. 15 – 33).

In the Examiner's arguments on page 3 of the Office Action, the Examiner makes the following comparisons between the different features of claim 1 and US Patent '756:

"A test pattern generator" is compared with test pattern generator 26 in '756: it is difficult to compare an electronic circuit which is only represented by a black box in the drawings of '756 without any further detail with a specfic combination of light sources;

"for alignment of a projected light from at least one projector onto a screen," in '756, there is no alignment of a projected light from a projector on a screen but '756 concerns the adjustment ("alignment") of different parameters for ensuring optimum reproduction image quality on the CRT screen (col. 1, l. 19 -28);

"comprising a plurality of directed light sources," is compared with the optical sensors 16 generating video image signals. In '756, the optical sensors are not part of the test pattern generator but are part of a test system. As already explained above, optical sensors are not directed light sources but are video cameras, receiving light information (images) and converting it into electrical signals (video image signals);

"the test pattern generator having a surface," is compared with the test fixture 14. In '756, the test fixture is not part of the test pattern generator, but is part of the test system, in particular the part used for capturing an image of the CRT-screen;

" each light source being moveable fixed on the surface and being individually adjustably settable such that a direction of light emitted from each light source can be set for directing light from the light source onto the screen," is compared with column 4, lines 36 through 52 of '756. In this passage, the general outline of the test and alignment system is described starting with the processing of the electrical output signals of the optical sensors 16 and their transmission to the computer 20. The computer 20 is connected to the test pattern generator 26 so that the computer can condition the test pattern generator to feed a certain test pattern to the CRT (see col. 8, l. 18 – 20). There is no mention of directing light from a light source onto a screen; although it can be understood that within the CRT an electron beam is directed to the screen under the control of the test pattern generator 26 and the scan unit 32 but there is no mention of a beam of any kind from the optical sensors 16 to the screen of the CRT.

"so that a test pattern is obtained on the screen composed of one or more pre-calculated points." In the test and alignment system of '756, a test pattern is obtained on the screen but there is no relationship with one or more precalculated points. Instead of this, some parameters of the test image are measured (using the output signals of the optical sensors which are fed to a computer) and depending on the results of these measurements, some elements of the CRT are adjusted in order to bring the different parameters to an acceptable

level. A certain number of examples of adjusting are given in '756 e.g:. improving the focus by adjusting the focussing voltage (from col. 8, l. 67 to col. 9, l. 2), improving color purity/ vertical raster shift/yoke rotation by moving the yoke or the purity rings (col. 9, l. 10 – 26), improving the static covergence by adjusting the magnetic correction device (col. 9, l. 61 – 67), etc. There is no indication in '756 that the direction of the optical sensors 16 (supposing for a moment that these optical sensors are equivalent to light sources, what they are not) is adjusted in order to obtain on the screen a test pattern composed of one or more precalculated points.

In relation with independent method claims 4 and 5, reference is taken to each of the arguments above for the corresponding features of device claim 1. On page 4 of the Office Action, the Examiner refers also in relation with claims 4 and 5 to the section "Calibration of the Wide-Angle Cameras" in US Patent '756. In this section, a method is disclosed for calibrating the Wide-Angle cameras by using a calibration grid which is formed of a sheet having a plurality of apertures. The apertures having a fixed position on the sheet, there can not be an individual setting of these apertures but all apertures are always moved together over the same distance and direction. In claim 4 of the present application, the direction of the emitted light can be set on an individual basis_in order to get a test pattern composed of one or more pre-calculated points and that is impossible with the calibration grid of '756.

Consequently, the subject matter of the independent claims 1, 4 and 5 on file is not anticipated by the cited prior art references.

Claims 2 and 3 being dependent on claim 1, these claims are also allowable. In order to be complete and taking into account the arguments raised by the Examiner on pages 3 and 4 of the Office Action, however, the following is also offered in relation with these dependent claims.

As to claim 2, in the Office Action reference is made to the wobulator 18 of '756. The wobulator consists of one or more coils for creating, when energized, alternating magnetic fields for bending electron beams within the CRT (see col, 6, l. 32 – 43). There is no link between such a wobulator and the stable plastic deformation of the sheet material described in claim 2.

As to claim 3, it is said in the Office Action that "there is no suggestion in the teaching of '756 supporting wobulator 18 deteriorates in performance over time." The subject of claim 3 however relates to the choice of " a material which does not work harden". This particular choice of a material is clearly different from the possible deterioration of the performance of an electronic circuit.

Given the above, and the fact that this response is being filed as part of a Request for Continued Examination, it is submitted that the application is now in condition for allowance, and the Examiner's further and favorable reconsideration in that regard is urged.

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Respectfully submitted,

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Marked-up version, page 2, line 7 - page 6, line 32

Brief description of the drawings

Fig. 1 is ~~a three dimensional view of~~ an arrangement of a projector, a screen and a device with adjustable directed light sources according to an embodiment of the present invention.

Fig. 2 is a front view of an array of adjustable light sources as in Fig. 1.

Fig. 3 is an enlarged detail of Fig. 2.

Description of preferred embodiments

According to Fig. 1 the ~~The~~ present invention proposes a method and a device for visualizing pre-calculated 50 points on a display screen 30 for projection, which pre-calculated points are intended to be used for guiding ~~projector~~ alignment of a projector 40. The method according to the present invention uses an array of directed, e.g. bundled light sources, e.g. solid state lasers or similar directed light sources. Alternatively; a single light source may be used, e.g. a laser, and a light guiding means such as a plurality of optical fibers is used to direct the light towards a screen.

A preferred embodiment is a box-like structure 2, as represented in Fig. 1 comprising a front plate 4 and a back plate 6, which are kept at a distance from each other by distance holders 8. The front plate may be flat or may be shaped, for example to provide easier manipulation of the light sources, e.g. curved if the screen is curved onto which the light is to be directed. The front plate 4 is provided with an array of light source locations for attaching light sources 10. Such locations may for example be holes 12 through which the light sources, such as for example lamps such as lasers, e.g. lasers diodes, are positioned from the back to the front. Alternatively, it may, for example, be places onto which light sources 10 are mounted at the front side, for example by screwing. In that case, preferably holes are provided for passing through power cables, which connect the light sources 10 to a power source (not represented). This later embodiment has the advantage that in case of break-down of one of the light sources 10, that light source can easily be changed from the front side. In any embodiment according to the present invention, the light sources 10 are fixed, preferably firmly fixed to the front plate 4 by any suitable fixing device but that the direction of directed light emitted from the light sources can be adjusted. Also, after adjustment the direction of the light should be stable, i.e. after adjustment there should be a resistance to any further

movement of the light source. Preferably, the light sources should be adjustable by hand, preferably by one hand. The light sources need not be a plurality of lamps. The light could be provided by a single lamp, e.g. a laser light source and the light is split up using a plurality of optical fibers. The end of each optical fiber is moveably fixed to the front plate 4 so that light emitted from the end of the optical fiber can be directed. A suitable lens system to collimate the light beam emitted from the end of each optical fiber may be provided.

The box-like structure may have a sufficient surface area for containing a plurality of such light sources 10. It may, for example, contain a 5x5 matrix (as represented in Figs. 1 and 2), or a 6x5 matrix of lasers 10. Means are provided to mechanically adjust the light sources 10 to illuminate individual grid positions each independent from the other on a screen. The adjustment preferably allows movement along two directions at an angle to each other, for example two directions orthogonal to each other.

The array of light sources 10 is mounted, preferably by fixing it with its back plate 6 onto a firm surface, for example a wall, a pillar, a stand of a projection device or any other suitable surface. The array of light sources 10 is calibrated using for example a laser theodolite or equivalent device to indicate on a projection display one by one the desired grid points. In order to do this, the laser theodolite needs to be positioned in a well-specified point, for example the eye-point of the operator that will be using the simulator, if the device of the present invention is to be used in a simulation environment. The array of light sources 10, however, does not need to be positioned in a particular place such as at the eye-point, as long as it can project onto the projection display. This facilitates the use of the device of the present invention. Preferably, however, the array of light sources 10 is put at a location where the degree of articulation or movement of the light sources 10 is as small as possible, although this is not critical.

For each desired grid point 50 on the screen 30, one light source of the array is aimed by mechanically adjusting and securing the light source 10 to that position so that it can reproducibly direct light in this direction D. Therefore, a mechanical system is provided in the neighborhood of each light source location to adjust the direction of light emitted from each light source 40.

This system may consist of any system capable of providing movement in two directions at an angle to each other, especially in both azimuth and elevation directions. The movements may be rotations, e.g. rotations in orthogonal directions, for example the light sources may be gimbled. The light sources may be articulated so that movement is provided at joints. The range of movement depends upon the size of the display screen and may

typically have a rotational range of +/-30 degrees in both axes. This range of movement may affect the number of arrays or thus the number of box-like structures 2 required for aligning the projection device(s) 40 in a projection system.

In a preferred embodiment, as represented in Figs. 2 and 3, the system for adjusting one light source 10 comprises two sets 14, 16 of coaxial elliptical cuts into the front plate 4. The front plate 4 may be made of a sheet metal, especially a metal with a low degree of work hardening such as copper for example. Each set 14, 16 of elliptical cuts consists of two cuts 14a, 16b and 16a, 16b along the edge of an ellipse. The cuts along the edge of an ellipse are incomplete, leaving a pair of short segments of metal 18 at opposite edges of the ellipse. The two pairs of metal segments 18, obtained by the two sets 14 16 of incomplete elliptical cuts, are preferably arranged in such a way that they are equidistant from the center of the ellipses formed by the light source locations, holes 12 in the embodiment represented in Figs. 2 and 3. An advantage thereof is that equal forces are needed to aim the light source 10 by displacements in equivalent azimuth or elevation directions. Furthermore, the elliptical cuts 14a, 14b, respectively 16a, 16b are preferably symmetrical.

Stress relief cuts 20 may be made at the ends of the cuts 14a, 14b, 16a, 16b to minimize stress concentration and to prevent the short segments 18 of metal from prematurely breaking off, thereby prolonging the life of the light direction adjustment system.

Normally many such sets 14, 16 of cuts are arranged in a pattern, especially a regular pattern on a single sheet metal or front plate 4, forming an array of adjustable light sources.

The light source 10, which is mounted along the axis of the ellipses along the edges of which the cuts are made, is then mechanically moved, whereby the metal segments 18 act as hinges. Metal is generally placed into plastic deformation when the light sources are manipulated. This can be done by providing an adjustment tool, for example consisting of a hollow pipe or tubular structure which fits over the protruding part of a light source 10 which projects from the front plate 4. Light from the light source 10 is projected through the hollow pipe on and is aimed to a desired grid point 50 on a screen 30. This aiming to the desired grid point 50 is obtained by adjusting the direction of the light source 10, i.e. by moving the direction of the light source thus placing the metal segments 18 around the light source 10 in plastic deformation. Moving the adjustment tool fitted over the light source results in moving the light source or thus in adjusting the position of, and direction of the light from the light source. In another embodiment, the light sources 10 can be motorized to ease the alignment procedure.

Preferably, the front plate 4 is firmly fixed to the back plate 6 by means of the distance holders 8, for example by screws through holes 22, so that a movement of one of the light sources 10 in one direction does not influence the position of a neighboring light source 10.

It is an advantage of the present invention that the directional adjustment of the light sources 10 can be carried out with one hand. It is a further advantage of the present invention that few tooling aids are needed for directional adjustment of the light sources. It is a further advantage of the present invention that the light sources are adjustable from the front side, the side located towards the screen and which is easily reachable, which makes the operation a lot easier.

The process of mechanically adjusting a light source 10 is repeated for all light sources 10 in the array. By extension, multiple arrays can be used to mark a complete a multi-channel system. One light source array can be used per display, however, a one-to-one correspondence is not necessary. The number of light sources per array is arbitrary and may be dependent of the physical situation and the complexity of the system; however, 30 seem to be a reasonable value.

Optimizations may be added to facilitate the capture and adjustment of the sources.

Once all arrays are aligned by means of the theodolite or equivalent device, they can be used for the initial and subsequent alignments of the system and as a permanent maintenance tool to verify the alignment of the display system. Therefore, a drive-box may be included to control the on/off function of the lasers.

If an array of 6x5 light sources 10 is provided, for example a 5x5 subarray of light sources 10 may be used for a normal alignment, as described above. The remaining 5 light sources 10 may be used for indicating the outline and centre point of a non-aligned projector 40. This may be helpful in case of break-down of a projector, when a projector 40 has to be replaced by another one. In principle, if the warp parameters of the first projector, which are the parameters which refer to the alignment of the projector so as to give a desired output image, are read into the new projector 40, projection of images should be correct if the new projector is mechanically located at the same position as the previous projector. With the 5 remaining light sources, it can be checked whether the new projector 40 is really in the correct place. If not, the new projector 40 may first be adjusted so that its centre point and outline fall at the same locations as the centre point and outline of the previous projector. After this, the alignment with the 5x5 array can be carried out.

In another embodiment of this device, the light sources 10 may be configured such that combinations of lights may be enabled or disabled. For example, it may be possible to individually turn on the center light, the corner lights, or other combination of lights to aid in the alignment process. A controller unit may be provided for this purpose.

Once all light sources are set, the light emitted from each light source generates a discrete image component, or a light area, on the screen. As each light source is individually movable, the position of each individual image component or light area is individually settable. The discrete image components form a test pattern.

At least one projector 40 is then adjusted using the generated test pattern 50 comprising the plurality of individual image components. The type of projector 40 used is not a limitation on the present invention, e.g. it may be a CRT projector, an LCD projector, DMD or similar. Also the input to the projector may be analog or digital video signals. Adjustments to the projector 40 which may be carried out may comprise the following: convergence, geometry, adjacent geometry and overlapping geometry.

Adjustment of the convergence means that the different colours that are projected onto the screen 30 are aligned with each other.

When adjusting the geometry it can be investigated, inter alia, whether or not the projected straight lines exhibit a degree of curvature ('bow' or 'pin') and whether or not lines which should be horizontal or vertical on the screen 30 have a degree of slope ('skew' or 'key').

Adjustment of the adjacent geometry is the adjustment of the geometry of pictures which are projected adjacent to each other by two projectors 40 (perhaps with a small overlapping zone in which soft edge is adjusted).

Overlapping geometry adjustment is the adjustment of the geometry of pictures projected on top of one another via two projectors.

While a particular form of the invention has been illustrated and described, it will be apparent that various modifications can be made without departing from the spirit and scope of the invention.